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# BULK MILK TANKS on OHIO FARMS

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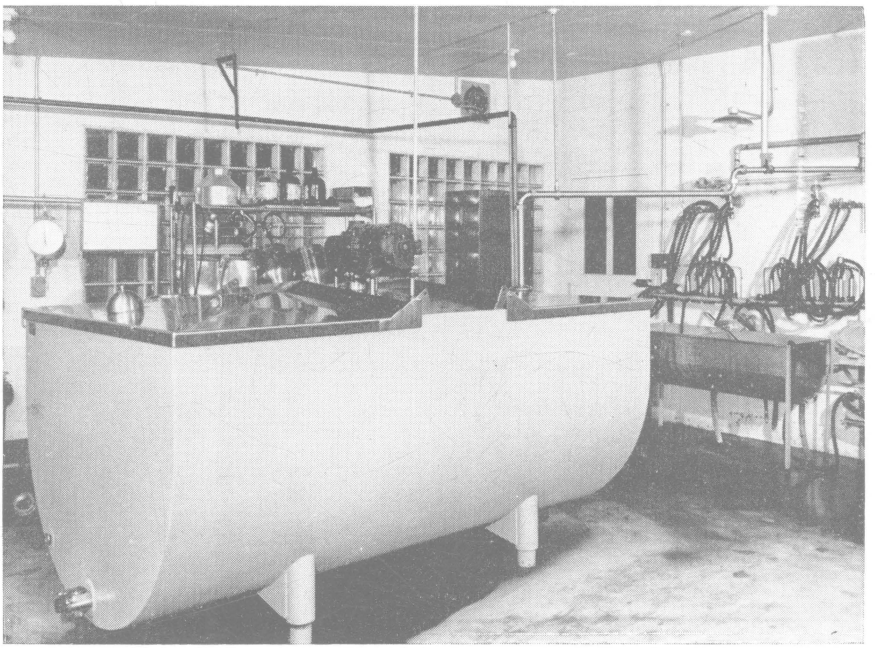

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# BULK MILK TANKS ON OHIO FARMS

E. F. BAUMER and DALE H. CARLEY

## INTRODUCTION

Bulk milk handling, promises to become one of the most important basic changes in the milk industry in this decade. This development occurred first in the Los Angeles, California milkshed in 1939. Commercial dairy farms in that area producing approximately 1000 gallons of milk per day initiated the bulk system. Similar conditions were present in Florida in which few producers were producing large amounts of milk, therefore the development soon spread to that state. Progress in bulk milk handling has developed in these two states until at the present time the bulk system is the most common, with many areas receiving all milk by bulk.

During the war period development was slow with producers of other states showing little interest in the system. In 1948 the bulk system was adopted in Connecticut, one of the first large scale developments in a state having producers of somewhat smaller size than those in California and Florida.

As the system developed on many of the smaller eastern farms, equipment manufacturers became interested and began making improvements in the design of the tanks to facilitate their use by smaller producers. Regional trends in adoption indicate the most rapid expansion in the Pacific Northwest and several areas in the East North Central States. For example the Chicago market had 2,212 producers shipping by bulk in August, 1955 or about 10.1 percent of the total farms serving the market.

Some principal reasons in the early development of the change from can to bulk were the problems of labor and sanitation involved in the handling of the numerous containers both at the farm and in the dairy. It was thought that by a savings in labor the milk could be transported more cheaply. Also, that a higher quality milk could be secured and maintained.

## HISTORY IN OHIO

Bulk handling of milk in Ohio began in the early part of 1952 in two markets. Since that time progress has been steady but slow until in 1955 when bulk milk handling was initiated in several areas of the

state. An estimate of the number of farm tanks in use in November of 1955 was approximately 850. It seemed likely that most sections of the state have or will soon have some development of bulk handling.

Several problems involved in the development of the bulk system in several areas of the United States are being examined. Many questions have been raised as to the practicality of the bulk system in Ohio milk markets. The bulk system of handling milk from the farm to the plant involves the use of expensive equipment both by producers and haulers. Both are concerned with the utilization of this equipment at as high a rate of efficiency as possible.

Through a study of the bulk development in a market and a review of studies already published, it is believed this publication can serve as a guide in the bulk tank development.

## HOW FAST IS THIS SYSTEM REPLACING CAN METHODS?

Many producers are inquiring as to how fast the bulk system will develop in their market area. A look at some other states may help answer this question. In California where the first bulk route was developed before the war, there are approximately 3,000 farm tanks in use.

Wisconsin is converting to bulk tanks at a rather rapid rate since the first route in 1951. As much as 90 percent of the milk produced in Florida is being delivered in bulk. A recent estimate indicated that by July of 1955 there would be more than 25,000 farm bulk tanks in the United States[1].

In Ohio, the first routes were started early in 1952. By December 1, 1955 a report from 86 counties indicates that there were 37 plants receiving bulk milk from 850 farmers owning farm bulk tanks. This would represent about 3 percent of the approximately 27,000 fluid milk producers in the state.

Several factors will have an effect on development of bulk handling in Ohio. Size of herds is important with indication that the average herd size is increasing. This will tend to expand bulk handling. Milk prices to producers are also important. A relatively favorable dairy price-cost situation will tend to stimulate development. Other factors affecting conversion are the attitudes of dealers, producers, present haulers, and credit agencies. These factors vary widely depending on the community. Table 1 indicates the increase in milk production per producer from 1950-1955.

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[1]Charles O. Davis, Jr., Bulk Pick-up-Gains Momentum, **Milk Plant Monthly,** May, 1955, Kansas City 5, Missouri, pp 15.

**TABLE 1.—Daily Average Production per Producer and Yearly Percentage Change in Seven Selected Ohio Federal Order Markets, Annually, 1950—1955**

| Year | Daily average production per producer (Pounds) | Percentage change (Increase from previous year) |
|---|---|---|
| 1950 | 233 | ——— |
| 1951 | 239 | + 2 58 % |
| 1952 | 253 | + 5.86 % |
| 1953 | 276 | + 9.09 % |
| 1954 | 294 | + 6.52 % |
| 1955 | 323 | + 9.86 % |

Source: Compilation of Statistical Material by the Market Administrator of Each of The Seven Markets.

## COSTS OF CHANGEOVER

Producers are primarily concerned with the cost involved in making the change from can to bulk handling of milk. Equipment costs are high; an estimate of the costs for the changeover for an entire market involving 2,000 producers would be approximately 4 million dollars for bulk equipment only. The average list price FOB factory for a 300 gallon bulk farm tank would be $2,200 to $2,600 depending on the type of tank purchased (Table 2 and 3). The prices listed in Table 2 and 3 do not include costs of shipping, installation, or calibration. All these costs amount to a sizable investment, but proponents of the system say that, unlike many other agricultural investments, this equipment will be used every day of the year, therefore, returns on the investment are reasonable.

The cost of equipment may not represent the entire cost of changing to the bulk system. In many cases milk houses must be enlarged or somewhat changed to accommodate the new equipment. Floors may not be strong enough to support the added weight, especially since the added weight may be concentrated in four or six points. Additional outlay for a drive to the milk house capable of handling a loaded tank may be required. Electric power lines to the farmstead and especially to the milk house may have to be changed. Many bulk tanks are equipped with a 3 to 5 HP electric motor to run the compressor. Also the disposition of the cans and can cooler may enter into the total cost of conversion. As this system expands, the demand for can coolers will decrease. For proper cleaning it is essential to have hot water under pressure readily available. These represent the major costs, however there may be other miscellaneous costs such as cleaning brushes etc.

It is recommended that producers anticipating the purchase of a tank investigate the following points.

1. Discounts on equipment ranging from 10 to 25 percent and over may be available where tanks can be handled wholesale (cooperatives and sometimes milk dealers).
2. Tanks are available with various dimensions. Buying a tank that fits a milk house may save additional costs.
3. Trade in value of can cooler.
4. Costs and availability of service for the bulk tank cooler.

**TABLE 2.—Capacity, Price Range, Average List Price FOB Factory and Average Cost per Hundredweight of Capacity. For Ice Bank Type Farm Bulk Tanks (August 1, 1955)**

| Capacity of farm tank | Compressor* | Price range† | Average list price‡ | Average cost per hundred-weight of capacity |
|---|---|---|---|---|
| (gallons) | | (dollars) | (dollars) | (dollars) |
| 100 | Air | $1248–1565 | $1360 | $158.13 |
| 150 | Air | 1398–1691 | 1582 | 122.64 |
| 150 | Air and water | 1741–1911 | 1826 | 141.55 |
| 200 | Air | 1575–1943 | 1830 | 106.40 |
| 200 | Air and water | 1993–2273 | 2133 | 124.00 |
| 250 | Air | 1973–2075 | 2044 | 95.00 |
| 300 | Air | 2083–2366 | 2215 | 85.85 |
| 300 | Air and water | 2306 | 2306 | 89.38 |
| 400 | Air | 2500–2649 | 2578 | 74.94 |
| 500 | Air | 2800–3285 | 3091 | 71.88 |
| 600 | Air | 3650–3705 | 3677 | 71.25 |
| 700 | Air | 3550–4275 | 3966 | 65.88 |

*Compressor air cooled or air and water cooled designed for every other day pick-up.

†Low and high price of coolers in the data compiled.

‡List price includes complete tank but does not include freight or costs of installation. Exterior covering in most cases not of stainless steel; add 10% extra for stainless steel exterior.

Costs based on data secured from:

Cherry-Burrell Corp., Chicago, Ill.; Nichols Refrigeration Co., Medina, Ohio; Girton Manufacturing Company, Millville, Pa.; Wilson Refrigeration, Inc., Smyrna, Delaware; The DeLaval Separator Co., Poughkeepsie, N. Y.; Haverly Electric Co., Inc., Syracuse, N. Y.; C. E. Howard Corporation, South Gate, California; Van-Vetter, Inc., Seattle, Washington; Groen Mfg. Co., Chicago, Ill.; Emil Steinhorst and Sons, Inc., Utica, N. Y.

## SIZE OF TANK

Along with cost consideration it is important for a producer to choose the proper size tank for his dairy enterprise. Unlike the milk can system additional units cannot be purchased at relatively low cost.

Two estimates are necessary; first, an estimate of daily production at the peak period of the year and second, an estimate of the future expansion of the production unit. The tank should be large enough to hold five milkings, considering that the milk will be picked up every-other-day. Providing space for the fifth milking will allow for some

**TABLE 3.—Capacity, Price Range, Average List Price FOB Factory, and Average Cost per Hundredweight of Capacity, for Direct Expansion Type Farm Bulk Tanks (August 1, 1955)**

| Capacity of farm tank | Suggested size and type of compressor | Price range* | Average list price—Tank only† | Average list price—Compressor only‡ | Total average cost | Average cost per hundredweight of capacity |
|---|---|---|---|---|---|---|
| (gallons) | | (dollars) | (dollars) | (dollars) | (dollars) | (dollars) |
| 100 | 1 Hp. Air | $1036-1175 | $1105 | $ 459 | $1564 | $181.86 |
| 150 | 1 ½ Hp. Air | 1070-1405 | 1222 | 581 | 1803 | 189.77 |
| 200 | 2 Hp. Air | 1251-1712 | 1460 | 730 | 2190 | 127.33 |
| 250 | 2 Hp. Air and water | 1427-1700 | 1574 | 855 | 2429 | 112.98 |
| 300 | 2 Hp. Air and water | 1514-1948 | 1782 | 855 | 2637 | 102.20 |
| 400 | 3 Hp. Air and water | 1794-2172 | 2051 | 1074 | 3125 | 90.84 |
| 500 | 3 Hp. Air and water | 2008-2543 | 2291 | 1074 | 3365 | 78.25 |
| 600 | 3-5 Hp. Air and water | 2155-2822 | 2533 | 1074 | 3607 | 69.90 |
| 700 | 5 Hp. Water | 2708-2785 | 2733 | 1410 | 4143 | 68.82 |
| 800 | 5 Hp. Water | 2961-3255 | 3130 | 1410 | 4540 | 65.99 |
| 1000 | 5-7 ½ Hp. Water | 3282-3493 | 3402 | 1410-1458 | 4865 | 56.51 |

*Low and high price of coolers in data compiled.

†List prices includes tank only, does not include compressor, freight, or installation, or cost of compressor controls. Add 10% extra for stainless steel exteriors. Add 10% extra for compressor controls.

‡Includes single phase 230 V. motor.

Tank and compressor costs based on data secured from:
Van-Vetter, Inc., Seattle, Wash.; Groen Mfg. Co., Chicago, Ill.; Damrow Brothers Co., Fond du Lac, Wisconsin; C. E. Howard Corp., South Gate, Calif.; The DeLaval Separator Co., Poughkeepsie, N. Y.; Emil Steinhorst and Sons, Inc., Utica, N. Y.; Girton Mfg. Co., Millville, Pa.; The Creamery Package Mfg. Co., Chicago 7, Ill.; Copeland Refrigeration Co., Sidney, Ohio; Brunner Mfg. Co., Utica, N. Y.; and Frigidaire, Dayton, Ohio.

fluctuations of daily production as well as increases in the herd size. After making the above estimates, guides to the proper size of tank can be found by referring to Table 4.

**TABLE 4.—Suggested Sizes of Bulk Tanks for Various Levels of Peak Milk Production**

(Capacity Needed for Storage of Five Milkings)

| Production per day | Production per day | Capacity needed for storage of five milkings | Suggested bulk tank size |
|---|---|---|---|
| (gallons) | (pounds) | (gallons) | (gallons) |
| 25 | 207 | 63 | 80* |
| 40 | 330 | 100 | 100 |
| 50 | 415 | 125 | 150 |
| 60 | 500 | 150 | 150 |
| 80 | 665 | 200 | 200 |
| 90 | 750 | 225 | 250 |
| 100 | 830 | 250 | 300 |
| 125 | 1040 | 312 | 400 |
| 150 | 1250 | 425 | 500 |
| 175 | 1450 | 440 | 500 |
| 200 | 1660 | 500 | 500 |
| 300 | 2490 | 750 | 800 |
| 400 | 3440 | 1000 | 1000 |

*A few 80 gallon sizes are available.

With the use of bulk tanks it is highly desirable to have an even production throughout the year. Costly inefficiency would result if a producer has to buy a larger size tank to hold the extra production of the flush months and have the tank partly full the remainder of the year. Initial investment would be higher and average cooling costs per hundred pounds of milk would be higher.

After determination of the proper tank size, the next consideration will be the availability of space in the milk house. Most city board of health recommendations require two feet of space around all sides of the tank. By careful observation a producer will discover that outside sizes of tanks vary considerably. Some tanks may fit a producers milk house with little change.

## TYPES OF BULK TANKS[2]

Bulk tanks are generally referred to as cold wall type tanks, that is, the walls of the tank are refrigerated and the milk is stirred by an agitator located in the tank. Tanks can be classified as direct expansion, ice bank, or a combination of these two. They may be further classified as vacuum or atmospheric types. A brief description of each type follows.

In the ice bank type of tank a reserve of ice is built up by the cooling unit during the time between milkings. Water is circulated over the ice and around the walls of the tank as fresh milk is poured into the tank. The compressor on the ice bank is usually attached to the tank and both are installed as a unit. This type of tank with an air-cooled condensor requires about 1/3 horsepower of compressor motor capacity for each 50 gallons of milk cooled at each milking. A relatively small condenser is used on an ice-bank cooler, therefore it must operate more hours per day, and the electrical consumption is somewhat higher. The size or the efficiency of the condensing unit on the ice-bank cooler does not directly affect the rate of cooling milk. Once the ice-bank has been formed, the water circulation and not the operation of the condensing unit determines the time required to cool the milk.

A direct-expansion type cooler has the cooling coils placed against the bottom of the inside liner. The tank begins operating when fresh milk is poured into it. It then runs until the milk is cooled to the set temperature. Because the tank operates only a short time a larger compressor is needed than on an ice bank tank. A 1 horsepower compressor motor is required for each 50 gallons of milk cooled at each milking. The size and efficiency of the condensing unit directly affects the rate of cooling.

Vacuum type tanks are constructed to allow the farm tank and the milking machine to operate as a unit. Milk is drawn directly from the cow, through the pipeline and into the tank without the use of a releaser. This type tank must be built in a cylindrical shape to withstand the 12 to 15 inches vacuum under which a milking machine operates making it more expensive. An atmospheric tank, the most common used, can be used with or without a pipeline milker system. The

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[2]Information in this section has been obtained from **Bulk Cooling and Storage on the Farm,** Cornell Extension Bulletin 899, Cornell University, Ithaca, New York, pp 56, and consultation with Delbert Byg, Extension Agricultural Engineering Specialist, The Ohio State University, Columbus, Ohio.

tank is easier to clean because of the large accessible covers. Its cost, plus the cost of a releaser (if using with a pipeline system) is usually less than a vacuum tank. In conclusion these comparisons can be made:

Icebank Type

1. Smaller compressor and motor.
2. Requires circulating pumps for water.
3. Rate of cooling is not related to running time.
4. Heat is given off over a longer period of time which may aid milk house heating during cold weather.
5. Impossible to freeze milk as water is used as the heat exchange unit.

Direct Expansion Type

1. Larger motor and compressor.
2. Cools milk directly.
3. More efficient operation (no circulating water).
4. Rate of cooling directly related to running time.
5. Possibility of freezing milk.

An ice bank cooler will cost about $400 less but will cost slightly more to operate than a direct expansion. Over a long period of time both will tend to be about equal in costs.

## COST OF TANKS VS. CAN HANDLING

A producer can consider the advisability of a changeover by obtaining some knowledge of the costs of his present system compared with the bulk system. Such a comparison is made in Tables 5 and 6. These costs include depreciation, interest, and repairs and maintenance. At a maximum daily production of 510 pounds (60 gallons) and using cans and mechanical cooler, the daily cost per hundredweight would be 3.6 cents compared with an average of 9.3 cents for a bulk tank. At most levels of production, the can method cost of investment is less than the bulk method though the difference decreases as the production increases. Figures in the far right column of Table 6 represent the difference in equipment costs of the two systems.

The costs for the bulk equipment are derived by taking the average list price for ice bank and direct expansion and depreciating this equipment over a 15 year period. A five percent interest charge has been added along with a two percent repairs and maintenance cost.

**TABLE 5.—Purchase and Installation Costs, Investment per Hundredweight of Capacity, Daily Fixed Costs of Various Sizes of Can Storage Cabinets and Refrigeration Units, Can Cost per Day, and Total Cost per Hundredweight of Daily Production, Western Washington, 1952**

| Production per day | | Total cost | Investment per CWT of capacity | Daily depreciation, interest, insurance, and repairs cost | Can cost per day | Total cost per day | Cost per CWT of daily production |
|---|---|---|---|---|---|---|---|
| Gallon | Pounds | Dollars | Dollars | Cents | Cents | Cents | Cents |
| 40 | 340 | 438 | 127.33 | 12.6 | 2.4 | 15 | 4.41 |
| 60 | 510 | 509 | 98.61 | 14.6 | 3.6 | 18 2 | 3 57 |
| 80 | 680 | 595 | 86.51 | 17.1 | 4.8 | 21.9 | 3.22 |
| 120 | 1030 | 666 | 64.54 | 19.1 | 7.3 | 26.4 | 2.56 |
| 160 | 1370 | 776 | 56.40 | 22 2 | 9.7 | 31.9 | 2.33 |
| 240 | 2060 | 886 | 42.91 | 25.4 | 14.6 | 40.0 | 1.94 |

Source. A Comparative Analysis of Costs of Farm Collection of Milk by Can and Tank in Western Washington, 1952, E. L. Baum and D. E. Pauls, State College of Washington, Pullman, Washington.

This total cost figure for one year was divided by the yearly production at the different levels of daily production. The bulk equipment costs are then compared with can equipment costs. Static conditions are assumed in calculating the various costs; that is, prices on equipment have been assumed to remain at the present level. Any increase or decrease in equipment costs will change the comparison.

Higher costs of the bulk system may be offset by lower hauler costs, gains in weights and tests, premiums, or other gains.

## SAVINGS AVAILABLE AS A RESULT OF BULK TANK

The amount of savings realized by the producers if converting may be realized from several sources. These sources of savings may result from an increase in butterfat test plus an increase in the weight of the milk sold, a reduction in hauling cost per hundredweight, or possible premium payments by the handlers.

There is considerable variation in the hauling rates for bulk milk in the various markets. A producer should not expect a great if any reduction in the hauling rate in a market that already has relatively low hauling rates. In many cases markets that have relatively high hauling rates have made considerable reductions in the hauling rates for bulk

**TABLE 6.—Comparison of Costs per Hundredweight of Daily Production for Bulk Tank Vs. Can System of Handling Milk**

| Capacity of farm storage tank | Production per day | | Average list price* | Cost of tank,† interest,‡ repairs and maintenance§ per hundredweight of daily production | Cost per CWT of daily production for can system‖ | Difference in cost of bulk tank and can system |
|---|---|---|---|---|---|---|
| Gallon | Gallon | Pounds | Dollars | Cents | Cents | Cents |
| 100 | 40 | 340 | $1462 | 12.0 | 4 4 | 7 6 |
| 150 | 60 | 510 | 1692 | 9.3 | 3 6 | 5 7 |
| 200 | 80 | 680 | 2010 | 8.3 | 3 2 | 5 1 |
| 300 | 120 | 1030 | 2426 | 6 6 | 2.6 | 4 0 |
| 400 | 160 | 1370 | 2852 | 5.8 | 2.3 | 3.5 |
| 600 | 240 | 2060 | 3642 | 5.0 | 1 9 | 3.1 |
| 700 | 280 | 2400 | 4055 | 4.7 | —— | —— |
| 800 | 320 | 2750 | 4540 | 4.6 | —— | —— |
| 1000 | 400 | 3440 | 4865 | 4.0 | —— | —— |

*Simple average of ice bank and direct expansion type bulk tanks
†Cost of tank based over 15 year period at daily production indicated.
‡Interest rate at 5% of the average cost of the tank.
§Repairs and maintenance at 2% of average cost for 15 years.
‖From Table 5.
Source: Tables 2, 3 and 5.

milk. For example, if market A had a hauling rate of 40 cents per hundredweight and market B had a hauling rate of 30 cents per hundredweight for can milk, a reduction to 25 cents per hundredweight for bulk milk in both markets would result in a 37½ percent reduction in market A and a 16 2/3 percent reduction in market B.

Factors to consider in determining the available savings, assuming static conditions of costs, are the average daily volume per producer, the length of the route, and the frequency of collection. Every-other-day pickup can effect a reduction in hauling costs.

Premiums or bonus payments are paid for bulk milk in some markets. A recent survey conducted by the USDA indicates the pattern over a wide area of the United States, of 98 firms reporting, 45 percent paid premiums for bulk farm milk. Nearly 69 percent of those

paying premiums reported the amount at from 5 to 10 cents a hundredweight. About 29 percent of the firms reported premiums of 15 cents or more.[3]

The pattern and amount of premium is not consistent among the markets. Handlers of one of the largest markets in the United States are offering as a minimum a 15 cents per hundredweight premium to the producers until three-fourths of the cost of the tank is paid. The question of the premium remaining at that figure after the tank is paid for will depend on the competitive situation in regard to the supply of bulk milk.[4] Generally, premiums are paid to producers as an incentive to induce them to change to bulk, thus enabling the hauler to receive the supply 100 percent by bulk. It stands to reason that the changeover would be more rapid in markets where premiums are paid than in markets where no premiums exist.

The savings gained from an increase in weight and butterfat test has been estimated at approximately 4 to 5 cents per hundredweight.

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[3]**Progress in Farm-to-Plant Bulk Milk Handling, Noel Stocker,** Farmer Cooperative Service, USDA, Circular 8, November 1954. PP. 22.

[4]Davis, Charles O., Op. Cit. PP. 23-29.

**Fig. 1.—The driver measures volume of milk in the tank and uses a table to calculate the weight.**

This figure is obtained by estimating the loss of milk from can dumping to be ½ pint per 10 gallon or .625 pounds per hundredweight of milk. Assuming a price of $4.00 per hundredweight for milk the gain would be 2.4 cents per hundredweight.

Also, it has been estimated that milk adhering to the lid will test 8 to 10 percent butterfat. It seems reasonable that some butterfat would be recovered by the use of the bulk tank both from less loss due to adherence to the lid and a more thorough mixing of the milk before the sample is taken. An estimate has been made the increase in value from recovered butterfat would amount to 1 to 2 cents per hundredweight.

## COSTS VS. SAVINGS FOR BULK

Every producer has a somewhat different situation, therefore making it difficult to state an exact figure on net savings. The principal costs of changing from the can system to the bulk system would be the following:

(1) Initial cost of bulk tank, plus interest, installation, and calibration.
(2) Depreciated value of old equipment, less resale price.
(3) Costs of changes required on milk house.
(4) Any other costs due to the conversion.

The total amount of savings available as a result of bulk handling would come from the following sources:

(1) Reduction in hauling cost per hundredweight.
(2) Increase in butterfat test and increase in weight of milk. (approximately 4 cents per cwt.)
(3) Premium or bonus payment for bulk milk.
(4) Any other gains.

Net savings per hundredweight of milk produced can be calculated by taking all the above items into account. Exhibit I will aid a producer in calculating his gain or loss by bulk tank conversion. A brief description of this exhibit follows. First, one must determine the size of the tank needed. Table 4 will aid in this calculation.

The cost of the tank is considered next. This should be the actual cost taking into account discounts offered and trade in value of the mechanical cooler. Installation and calibration costs, if not included in tank cost, should be added. Any costs resulting from changing the milk house electrical and wiring costs, or new floors etc. must be considered. If improvement of the driveway to the milk house or an addition of concrete aprons by the loading ports is necessary these costs should be included in the total cost.

The total costs for the changeover can be calculated. It is estimated that the tank and the other improvements will last for 15 years. Total costs divided by 15 will give the cost for one year.

Interest on the investment must be taken into consideration. Assuming a 5 percent interest rate, the interest costs for one year may be determined by multiplying the average investment by .05. An allowance for repairs and maintenance of the tank is calculated by multiplying one-half the initial cost of the tank by 2 percent. Adding the total cost for one year, plus interest, plus allowance for repairs and maintenance the total gross cost for one year is obtained.

Divide the total gross cost by 365 to get the cost for one day. Divide the total cost for one day by the average daily production to obtain the cost per hundredweight of milk produced.

Gains can be obtained by adding the savings in hauling, savings from an increase in butterfat test and weight, premiums or bonus payments, and any other gains. These gains should be calculated on a hundredweight basis.

The total gains per hundredweight minus the total cost per hundredweight should give some idea of the gain or loss expected as a result of the conversion.

For example, a farmer producing 100 gallons (860 pounds) of milk per day at his peak production would need a 300 gallon tank. (From Table 4). By investigation the producer has found a tank that will meet his needs priced at an actual cost of $1800, including a discount offered and trade in value of the can cooler. Assume installation and calibration costing $75 extra.

This same producer may find that he must reinforce his floor and change his wiring which will cost an additional $200. The total cost for the changeover so far would be:

| | |
|---|---|
| Cost of tank | $1800.00 |
| Calibration and installation | 75.00 |
| Milk house conversion | 200.00 |
| Total cost | $2075.00 |

Dividing the cost by 15 gives a total cost for one year of $138.33 considering that the costs will be amortized over a 15 year period. Allowance of 2 percent for repairs and maintenance times one half the cost of tank (average cost of the tank) would be $18 per year. A 5 percent interest charge on the average cost would amount to $51.87 per year. Adding total cost for one year plus repairs and maintenance plus interest charge would give $208.20 gross for one year.

$208.20 divided by 365 will give a cost of 57 cents per day. Dividing this cost by an estimated average daily production of 600 pounds would give a figure of 9.5 cents cost for each hundred pounds of milk produced.

Assuming that this same farmer could have his bulk milk hauled 5 cents cheaper than his can milk, plus an estimated 4 cent gain on gains in weight and test and the handler paying a 5 cent premium, the gains for bulk conversion would amount to 14 cents per hundredweight.

Subtracting 9.5 cents from 14 cents will leave a net gain of approximately 4.5 cents per hundredweight resulting from the conversion. It should be remembered that this is only a hypothetical example for one set of conditions.

## EXHIBIT I

### Calculate Gain or Loss for Bulk Tank Conversion

1. Determine the size of tank needed:

   Gallons of daily production at peak production period times 2.5 = Gallons production at peak period for five milkings. Size of tank needed from Table 4.

2. Cost of conversion:

   Cost of tank (Take into account discounts offered and trade-in value of can cooler. This should be actual cost.) $_____
   Installation cost (if not included above). _____
   Calibration cost (if not included above). _____
   Costs of converting milk house (included costs of change in size, wiring, etc.). _____
   Other costs. _____

   TOTAL COST $_____

   Divide total cost by 15[5] = total cost for one year

   (1) Total cost for one year. _____
   (2) Allowance for repairs and maintenance 2 percent (.02) times one half the cost of tank. (Average cost of the tank). _____
   (3) Interest 5 percent (.05) times average total cost. _____
   (4) Divide total gross cost by 365 = total cost per day. _____
   (5) Divide total cost per day by daily production in hundredweight[6] = cost per hundredweight of production. _____

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[5]Estimated life of tank 15 years. Estimated that other cost involved should be amortized over 15 years also.

[6]Estimated average daily production for at least one year

3. Gains from conversion:

| | | |
|---|---|---|
| (1) | Savings in hauling per hundredweight | $_____ |
| (2) | Gains in weight and test per hundredweight | .04 |
| (3) | Premium or bonus per hundredweight. | _____ |
| (4) | Other gains.[7] | _____ |
| | TOTAL GAINS PER HUNDREDWEIGHT | $_____ |

Total gains per hundredweight minus total cost per hundredweight = gain or loss expected from conversion. _____

There are factors other than the cost-gains factor to consider. Some of these are savings in labor, actual milk house changes, financing, route organization, and milk quality. In the following sections these factors will be given consideration.

## AMOUNT OF LABOR SAVED

The amount of labor saved for the producer by the use of bulk handling equipment does not appear to be great. There is some reduction in the amount of physical labor involved as the producer is not required to handle any cans. Cleaning the tank is a relatively easy job, at least no more difficult than cleaning cans satisfactorily.

Bulk tank is most economical at the higher levels of production. Therefore, many producers using bulk equipment are actually increasing the size of their herds to gain some efficiency. On some farms this may result in an increase in labor needs.

There is some saving of labor when a bulk tank is used in conjunction with a pipeline milker. Use of the bulk tank makes the pipeline milker more practical and results in more efficiency in the milking operation.

## THE MILK HOUSE IN RELATION TO BULK MILK HANDLING

The size and location of the milk house is another problem that the milk producer faces in converting to bulk tank handling. Bulk coolers vary considerably in size depending on type and make. A 300 gallon ice bank type cooler, (compressor attached) may take as much as 126 inches by 50 inches of space. The 300 gallon direct expansion (compressor not attached) may take 72 inches by 48 inches of space.

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[7]May include savings in labor, etc.

The health regulations in several markets indicate that there must be sufficient clearance on all sides of the tank for thorough cleaning. A minimum of 24 inches between the tank and walls or other equipment is required in most markets.

The milk house should be accessible to the tank truck and located near the barn. Tanks must be placed in the milk house so that the hose from the truck will reach the tank easily. Ordinarily trucks carry 16 feet of hose. Most regulations state that the hose must enter through a portal in the wall having a self-closing cover.

A bulk milk installation calls for running water in the milk house with sufficient pressure to enable the operator to properly wash and rinse the tank both inside and out. Before purchasing bulk tank equipment the producer should acquaint himself with local regulations and specifications in relation to the milk house.

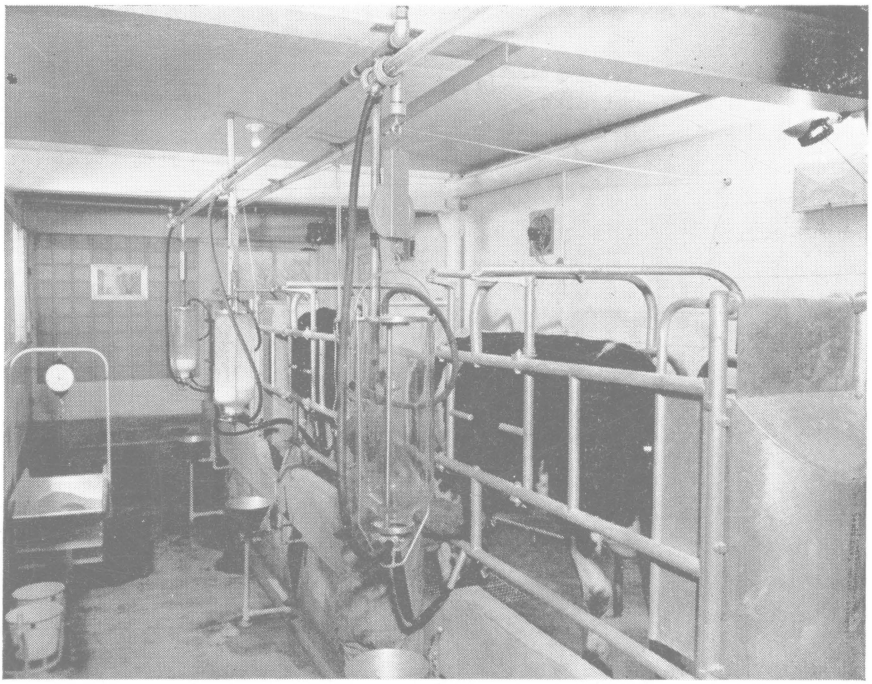

**Fig. 2.—A pipe line milker in connection with a bulk tank saves labor. This milker is used on the Castalia farm of the Ohio Agricultural Experiment Station.**

## FINANCING THE PRODUCERS CONVERSION COSTS

Any market that is considering initiation of the bulk system must consider the costs of conversion to the producer and methods of financing such a changeover. As was stated earlier the cost of 100% conversion in one of the larger markets in Ohio would amount to 4 million dollars for bulk tanks alone. The high initial cost of bulk tanks generally means that producers will need some help in financing.

Production Credit Associations in the state are generally willing to make loans for purchase of bulk tanks at their regular terms. Banks in some areas are interested in providing assistance.

Several plans may be used to pay off the loans on the tanks. One is to maintain can hauling rates and apply the reduction in rates toward payment. For example, assuming present transportation rates for the can system to be 40 cents per hundredweight and a savings of 10 cents per cwt. after switching to the bulk system, the producers would continue to pay 40 cents per cwt., 10 cents of which would go toward paying for the tank. A second method for payment is to deduct from the farmer's milk check a specified amount per hundredweight each month.

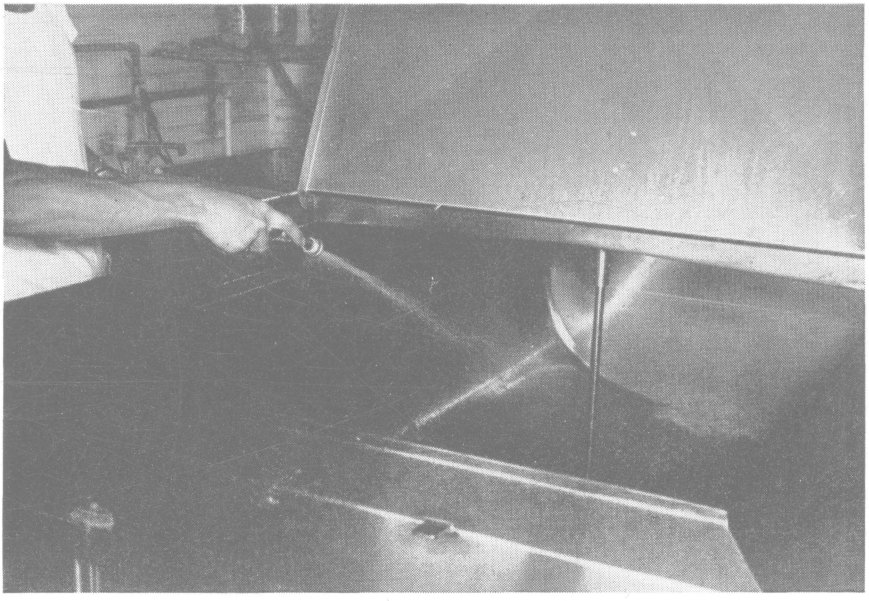

**Fig. 3.—Boards of health require water under pressure for rinsing the bulk tank on the farm.**

The payment of premiums for bulk milk in a market is another method used in providing financial aid. Handlers in a market guarantee to pay a specified premium to their producers until such time that the cost of the tank is paid off.

Producers organizations provide financing in some areas; at least many are in a position to either provide aid or give information for securing assistance. Before buying a farm bulk tank the dairyman should investigate all methods of financing available to him and select the one that best fits his needs.

## BULK ROUTE ORGANIZATION AND EFFECTS ON PRESENT CAN ROUTES

Bulk transportation in a market will bring some problems relative to the organization of new bulk routes and the maintenance of the present can routes. Larger producers are usually the first to convert to the bulk system, leaving only the smaller producers on the can routes. Hauling costs on the can routes may increase due to the loss of producers, or the hauler having to make more stops and travel longer distances to maintain a paying load of milk.

In the larger markets with many haulers the problem of maintaining can routes can be solved more easily. Several haulers could combine routes to maintain full loads of can milk. The loss of the larger producers on any can route will be serious to the hauler.

Dealers generally prefer to go 100 percent bulk as soon as possible. Many small producers may not be able to convert to bulk. Producers in this category may lose transportation for their milk, and therefore be required to find a new market.

Organization of bulk routes, especially in the larger markets, is important from an efficiency standpoint. Without proper planning criss-crossing of bulk routes will soon occur. There should be a plan by which producers and haulers can avoid haphazard route development. With the cooperation of producers and haulers and with proper planning new efficient bulk routes can be established. Also, producers remaining on cans will be provided with transportation for their milk.

## MILK QUALITY

Farm bulk milk handling, compared to can handling, does not improve the quality of the milk but will do a good job of protecting the quality of milk that is placed in the tank. This is accomplished through the rapid cooling of the milk and maintaining the product at a uniformily low temperature.

The tank is generally considered as being easy to clean. It has smooth rounded surfaces that can be readily cleaned, and sanitized.

In handling the product, the tank system varies from the can system. With cans the milk is in ten gallon units, however, in the tank with every-other-day pickup, the milk is collected and stored over a period of four milkings. Therefore, any poor quality milk from any one milking may seriously affect the overall quality of the mixed lot of milk in the tank.

Producers have questioned the advisability of mixing the different milkings together in the same container as is frowned upon in the can system. Generally, this is not a problem since this involves adding a small amount of warm milk to a large amount of cold milk. Usually the temperature of mixed milk is far below the critical temperature at which bacteria grow rapidly.

## CONSIDERATIONS AND CONCLUSIONS FOR PRODUCERS MAKING CONVERSION

1. Initial cost is high. Calculate the **total** cost of the change-over and compare this with the **total** possible savings expected.
2. Select the proper size considering five milkings at peak production and possible increases in herd size in the future.
3. Shop around for tanks. One design may fit your present facilities where others may be too large. Discounts are sometimes available; take advantage of them. Service on the coolers is an important consideration.
4. Savings depend on the market so no definite figure can be used.
5. Financing is available; select the source that fits your needs.
6. Total savings on labor may not be great. There is less physical work and a possible rearrangement of present producers may result in a labor savings.
7. Market considerations:
   a. Is your market ready for bulk?
   b. Every other day pickup is a must for greatest efficiency.
   c. Routes must have some organization to gain any savings.
8. Hauler considerations:
   a. Are facilities available for bulk transportation?

In bulk tank development some consideration should be given to the hauler and his problems. The next section will deal with some of these problems.

## COST OF THE TRUCK

Like the producer, the hauler needs to change his equipment. He must acquire a truck with a stainless steel tank to replace the van type truck. The truck should be equipped with a electric motor-driven centrifugal pump to load and empty the truck. This adds up to a large investment; however, the cost varies to a large degree on what size tank and chassis are used.

The average list price FOB factory per gallon capacity for the 1500 gallon truck tank with mild steel jacket is **$3.53,** the 1800 gallon **$3.22,** and the 2500 gallon tank is **$2.64.** Costs for stainless steel jackets per gallon of capacity are somewhat higher as indicated in Table 7.

## COSTS OF HAULING

Of concern to both producers and haulers are the hauling costs of can pick-up in relation to bulk pick-up methods. Producers have been told that hauling costs are less for bulk tank pick-up.

Baum and Pauls of Washington found that the operations costs per route mile were almost the same for the bulk tank truck as for the can truck. These costs included fuel and lubricants, tires, depreciation,

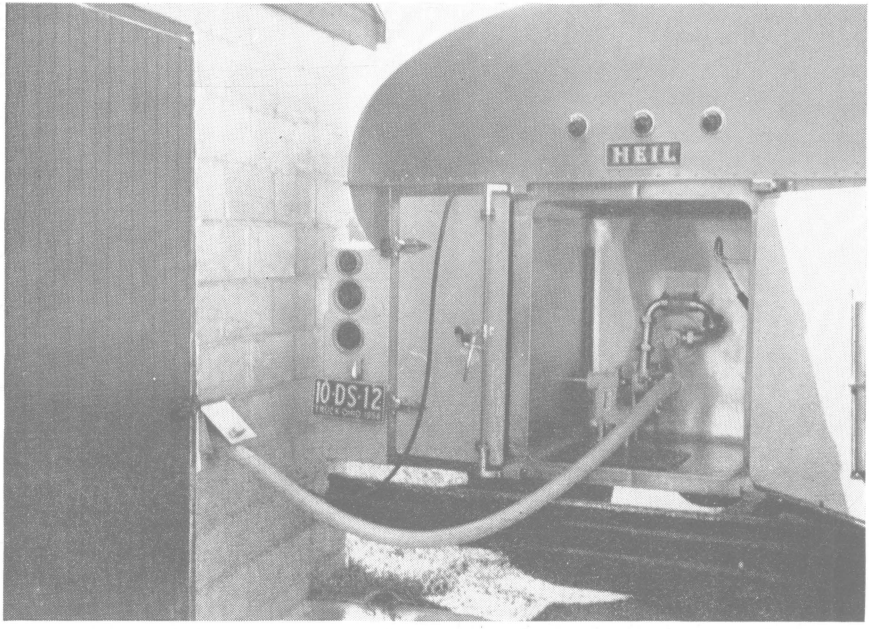


**Fig. 4.—Pump and plastic hose draw milk from the farm tank into a tank truck without exposing the milk to outside air.**

**TABLE 7.—Bulk Milk Truck Tank FOB List Price* Complete for Farm Pick-up† (July 1, 1955)**

| | Mild Steel Jacket | | |
|---|---|---|---|
| | 1500 gallon | 1800 gallon | 2500 gallon |
| Mgf. A | $5442 | $5889. | $6667. |
| Mgf. B | 5607. | 6053. | 6835. |
| Mgf. C | 4888 | 5410. | 6220. |
| Mgf. D | 5241. | 5812 | 6648. |
| Average price | $5295 | $5791. | $6592. |
| Average price per gallon of capacity | $3 53 | $3.22 | $2 64 |

| | Stainless Steel Jacket | | |
|---|---|---|---|
| | 1500 gallon | 1800 gallon | 2500 gallon |
| Mgf. A | $6007. | $6528. | $7503. |
| Mgf. B | 6028 | 6552. | 7460. |
| Mgf. C | 5463. | 6035. | 7095. |
| Mgf D | 5572. | 6143. | 7071. |
| Average price | $5767. | $6314. | $7284. |
| Average price per gallon of capacity | $3 84 | $3.51 | $2.91 |

*Does not include Federal Excise Tax.

†Does not include truck chassis.

Truck tank cost based on data secured from:
C. E. Howard Corp., Southgate, California, Portersville Stainless Equipment Corp., Portersville, Pa.; Cherry-Burrell Corp., Cincinnati, Ohio, The Heil Co., Milwaukee, Wisconsin.

interest, garage, repairs, insurance, taxes, and licenses. The costs, based on 23,725 route miles per year, were found to be 14.93 cents per route mile for a 1500 gallon tank truck and 14.09 cents per route-mile for a can pick-up truck capable of hauling 1500 gallons of milk.[8]

Savings can be realized on hauling rates of bulk by using every-other-day pick-up. By this method a greater amount of milk can be picked up per route mile. It is possible for one truck to cover more than one route. In some markets in Ohio one bulk truck can pick up two routes every other day or a total of four routes. The average can load for the Columbus market was 135 cans in May. If each can contained 8 gallons of milk this would be a volume of 1090 gallons per day.

[8]Baum, E. L. and Pauls, D. E., op. cit., PP. 7.

On every-other-day pickup, a truck with capacity of 1800 gallons could pick up 3600 gallons in two days. This would mean that 1800 of the 2180 gallons could be picked up one day with room for 1420 extra gallons the second day. Actually route miles per hundred pounds of milk should be less than by can pick up.

Savings in costs of hauling will vary according to local conditions. These savings depend on length of route, daily volume per producer, present hauling rate, and density of production in an area. In Ohio, reductions in hauling rates for bulk producers vary from 5 to 15 cents per hundredweight. Also, persons hauling bulk milk must be more highly trained than can haulers. This may increase the costs of hiring such individuals.

When new bulk routes begin, the reduction in rates is often less than after the route or routes are more efficiently organized. During this period the producers that have tanks are often scattered over a large area making it necessary for the bulk haulers to travel longer distances to fill their trucks.

## ORGANIZATION OF A BULK ROUTE

In any market that is developing bulk pick-up the organization of routes is important. Possible savings can soon be lost by improper route development. A market or a handler that changes to 100% bulk may not have this problem as the routes can be set up immediately.

In the larger markets where development is somewhat slower more difficulties are encountered. If a hauler has two or three producers wanting to change to bulk he may not be able to afford bulk hauling equipment, yet if he does not provide transportation the producer may change to another hauler or another market where he can secure bulk transportation. This may result in the loss to the haulers of larger producers and an inefficient can pick-up route.

The approach to this problem in the larger markets appears to be cooperation among the haulers. In the early development stage two or three haulers that have adjacent routes may buy a bulk tanker together, or one hauler may obtain the tanker to pick up bulk milk on the several routes. In any case the securing of bulk producers by raiding from other routes should be avoided. As more producers go bulk and another truck can be added then the haulers having adjacent routes might consider a rearrangement of their routes to travel the least miles for a load of milk.

Haulers remaining with can routes will obtain more small producers as bulk develops. This may add to the expense by requiring

more stops and longer driving distances. Some markets in Ohio are planning routes by the cooperation of all parties while others are giving this point very little guidance.

## QUALIFICATIONS AND RESPONSIBILITIES OF BULK TANK HAULERS

The duties and responsibilities of the hauler have increased many times over those expected of him when he hauled milk in cans. Now he must measure the milk and take butterfat samples. To be able to perform these tasks, the driver must be a licensed weigher and sampler. Also the driver has the responsibility of accepting or rejecting the milk at the farm.

In most cases the hauler must rinse the farm tank after the milk has been pumped on the tanker. All of these tasks are highly important to the producer and the handler and both will demand a qualified man to drive the tank truck.

Ownership of the tank trucks in Ohio has changed little from the conventional can system. Some trucks are owned by private haulers, others by the milk handlers, and some by the producers cooperatives. A USDA survey of 104 plants receiving bulk milk indicated that plants owned and operated 49 percent of the bulk pick-up trucks, "for-hire" haulers owned 44 percent of the trucks and producers owned 7 percent.[9]

Dairymen sometimes complain that they are at a disadvantage because they cannot change haulers as easily after going bulk. Desire for changing haulers usually results from the actions of unreliable haulers. As drivers of bulk tanks must be qualified men the problems of changing haulers should appear less frequently on tank routes.

## EFFECTS ON THE MARKETS

With bulk handling in its infancy in Ohio, producers may find that the outlet for their bulk milk is limited. In many areas only one or two handlers are receiving milk from producers using the bulk system. Availability of transportation is limited in the markets, especially in the large markets that spread out great distances for their supply of milk.

The size of the milk market shed is likely to increase with bulk handling. Once a tank truck is loaded, it can move a long distance for a small cost. This, however, is limited to some extent by the attitudes and enforcement procedures of local boards of health. Interstate and

[9]Stocker, Noel, op. cit., PP. 25.

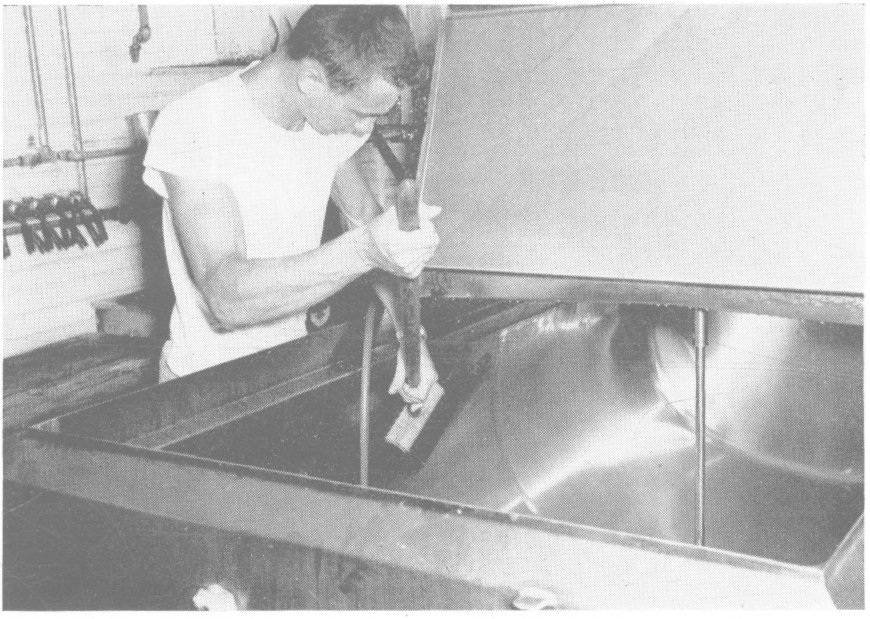

**Fig. 5.—The driver or the farmer washes the bulk tank on the farm immediately after milk is removed.**

intrastate movement can be expected to increase with the coming of bulk transportation. As a result, marketing practices and milk prices may become more uniform over the state.

As the milk shed increases the route length will increase for some of the bulk routes. The result may be that the increase in distance will absorb any savings gained, therefore the hauling cost advantage to the producer may be somewhat reduced.

The number of dealers buying milk by bulk may be limited by the size of the dealer. Table 8 indicates the number of dealers receiving various quantities of milk daily in several Ohio Markets.

The size of tank generally used is the 1500 or 1800 gallon size. This means many dealers will be required to make some sort of combination with other dealers to handle one load. The "under 500 gallon" dealer may have a difficult problem.

## SUMMARY

Handling milk by the bulk system is a basic change in the dairy industry. Originally it was thought that this system would be a labor saving method because of the elimination of many separate containers for milk.

**TABLE 8.—Number of Milk Dealers Receiving Various Average Daily Volumes of Milk in the Canton, Cincinnati, Cleveland, Columbus, Dayton, Springfield, Lima, Toledo and Tri State, Ohio Fluid Milk Markets, April 1954**

| Average daily volume | Number of dealers | Percent of dealers |
|---|---|---|
| (gallons) | | |
| 0 — 500 | 33 | 17 |
| 501 — 1000 | 36 | 18 |
| 1001 — 1500 | 21 | 11 |
| 1501 — 3000 | 39 | 20 |
| 3001 and over | 68 | 34 |
| Total | 197 | 100 |

Source Officers of Federal Milk Market Administrators in Canton, Cincinnati, Cleveland, Columbus, Dayton, Springfield, Lima, Toledo and Tri State, Ohio

Bulk handling started in Ohio in 1952 and at the present time it is picking up momentum. Late in 1955 there were approximately 850 producers shipping milk by bulk. Several factors will affect the speed with which it will develop in Ohio. Two of these are herd size and prices paid to producers for milk.

Secondary markets appear to be changing more rapidly to the bulk system. For the most efficient development in any market, some type of planning should be done. Each market has problems that are different than those found in other markets.

Changeover costs to the producer are relatively high. A 300 gallon bulk cooler will cost approximately $2200 to $2600. Producers changing over should consider all costs and not just equipment costs. In many cases milk houses need to be enlarged or wiring is inadequate.

Tank size is an important consideration. A producer should buy a tank large enough to hold five milkings at his peak production period. Also increases in the herd size should be taken into account.

In general there are two types of tanks; the cold wall and the direct expansion. It would be well to investigate both types as one may fit the situation better than the other.

Assuming production at 60 gallons per day the cost of a bulk tank to handle this production would be approximately 6 cents per hundredweight higher than that of the can system. The difference between the two decreases as the level of production increases.

With this increased cost producers are concerned with savings to make up the difference. Savings are possible from several sources as a

result of bulk tank. There may be an increase in weight and test, hauling rates may be less, and handlers in some instances offer premiums for bulk milk. Savings as a result of the above factors depend on the situations in the particular market.

A producer should estimate his costs and his possible savings on a hundredweight basis. The difference plus or minus should be an important factor in a decision whether to make the conversion.

Financial assistance can be secured by producers through their producers cooperatives, Production Credit Associations, or local banks. All sources should be investigated and the one used which will fit best.

Bulk routes require planning, especially in the larger markets. The present can routes may become more costly to operate with hauling costs increasing enough to make the can method unprofitable to the producer.

The quality of the milk should be as high if not higher by the bulk method. Milk is cooled quicker and is maintained at a lower temperature than in can coolers. Producers still need a good sanitation program.

The hauler also faces a higher investment in equipment. Costs per mile may be about the same as the present method but savings come about through every-other-day pickup. This makes it possible for haulers to pick up more than one route. In the beginning savings may not be available.

Responsibilities of the hauler increase when hauling by bulk. He accepts or rejects the milk at the farm and mixes it with other producers milk. Also the hauler is required to be a licensed weigher and sampler.

Milk shed areas will probably increase in size. This would indicate increased market outlets for producers. There will be more overlapping of market areas which should result in a more uniform price among the markets.

Any producer considering bulk handling should become familiar with the health regulations in that market concerning bulk milk.